E69 Motion

User manual

Developer	Date
Fernando Núñez Correas	12th February 2012

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1. INTRODUCTION

1.1 PURPOSE

The purpose of this document is to explain the operation of the E69Motion software.

This software has been developed to provide a user-friendly and intuitive tool for the operation of motion chassis that can be used to build a low-cost yet high-quality chassis.

The software functionalities are as follows: system calibration, vehicle motion data extraction, data processing, positioning of actuators and transmittal through LAN networks. The public APIs of simulator manufacturers and the public API, in the form of a DLL library, of the actuator manufacturers will be used. Once the information from the simulators has been obtained, the information will be processed and converted into a position on the actuator.

2. SYSTEM DESCRIPTION

Motion chassis have two clearly differentiated elements:

- Hardware: equipment that makes up the system (chassis, electronic actuators, power supply, cables)
- Software: program that obtains data from the simulators, processes the information and positions the actuators in such a way as to simulate the movement of a vehicle.

Users with E69Motion will be responsible for the assembly and installation of the hardware element. This document will present the list of components that the software has been designed for.

The E69Motion software has been developed by Fernando Núñez Correas. It may be distributed freely and used by anybody under a creative commons licence.

2.1 HARDWARE ARCHITECTURE

The hardware architecture for the construction and operation of the E69Motion software is as follows:

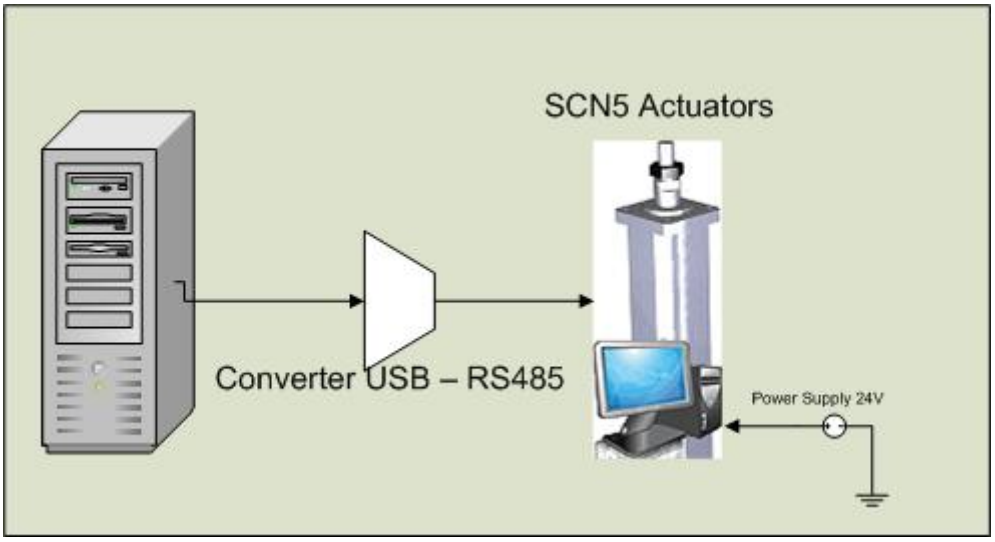

Figure 2-1. Hardware architecture

The hardware elements used are as follows:

- SCN5 electronic actuators
- Power supply: 24 V and at least 6A
- USB – RS485 converters
- USB connection cables
- Connectors for the supply and data actuators

- 27 V Zener diode 6A
- 2.2 Kohm resistor
- Emergency pushbutton

The wiring diagram is as follows:

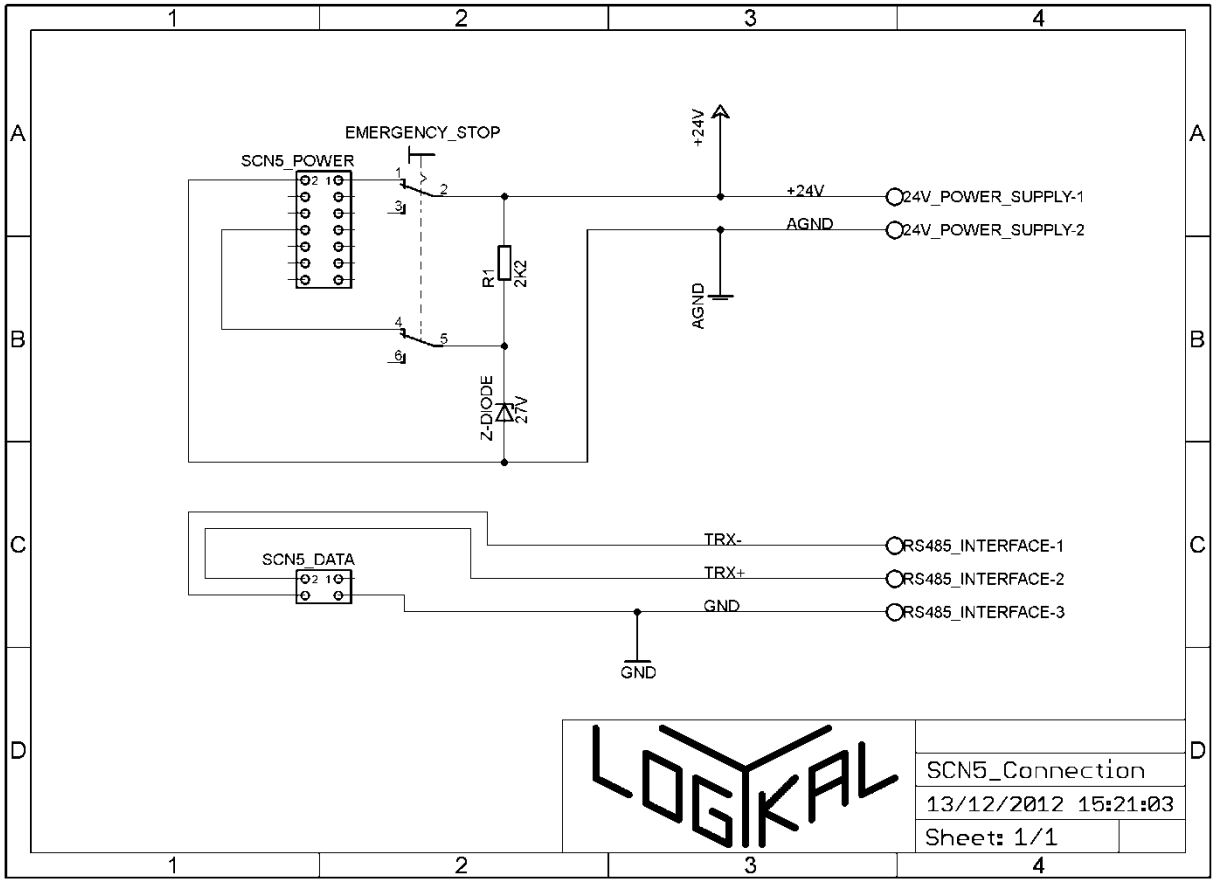

Figure 2-2. Wiring diagram

2.2 SOFTWARE ARCHITECTURE

The software architecture is based on a typical multi-thread software architecture. The threads are connected through an internal bus.

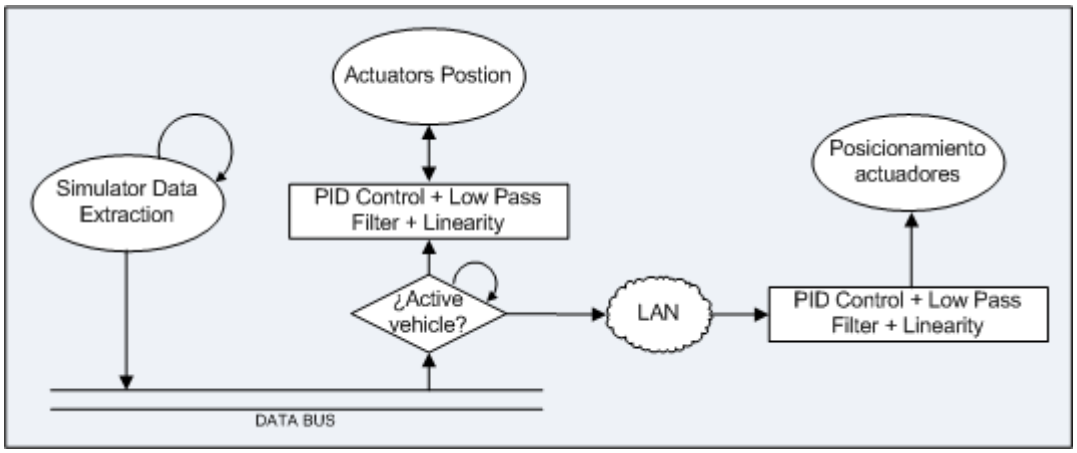

Figure 2-3. Software architecture

2.3 SOFTWARE REQUIREMENTS

The E69Motion software requires the following elements to be installed in a PC to operate correctly:

- 32/64 bit Windows XP/7 operating system
- .NET Framework 4
- Redistributable Visual C++

The user will have an installer that will copy whatever is required to make the application work onto the PC file system. A shortcut to the application will be created on the desktop.

2.4 SIMULATOR PLUGINS

The software communication with the simulators is done through the API provided by each of the simulators. Some do not require any action by the user, whereas others require files to be copied or configured in a given way.

The following list includes the instructions to be followed to operate the API of each simulator:

Simulator	Configuration
iRacing	N/A
Rfactor	Paste the E69_rfactor.dll plugin in the Plugins folder of the simulator.
Rfactor2	Paste the E69_rfactor2.dll plugin in the Plugins folder of the simulator.
Simbin series	N/A, except GTR2. Edit the user PLR: Write Shared Memory="1"
Codemaster series	Edit the hardware_settings_config.xml file of each simulator and include the following line: <motion enabled="true" ip="127.0.0.1" port="20777" delay="0" extradata="1" />
Kart Racing Pro	Paste the E69_kartracingpro.dll plugin in the Plugins folder of the simulator.
Live for Speed	Edit the cfg.txt file in the simulator folder with the following values: OutSim Mode 1 OutSim Delay 0 OutSim IP 127.0.0.1 OutSim Port 32069 OutSim ID 0 OutGauge Mode 1 OutGauge Delay 0 OutGauge IP 127.0.0.1 OutGauge Port 32169
RBR	Run the attached program: RBRRealtimePhysics.exe
Game Stock Car	Paste the E69_GameStockCar.dll plugin in the Plugins folder of the simulator.
SimRaceWay	Paste the E69_SimRaceWay.dll plugin in the Plugins folder of the simulator.
DCS World	** Instructions at the end of this table
X-Plane	Configure the export of pitch and roll data within the simulator.

Fligth simulator	N/A
IL2 1946	Add this section to the conf.ini file: [DeviceLink] port=35069
Falcon 4	N/A

** Instructions to configure DCS World:

Modify the export.lua file and include the following parameters in the functions:

function LuaExportStart():

```
package.path  = package.path..";.\\LuaSocket\\?.lua"
package.cpath = package.cpath..";.\\LuaSocket\\?.dll"
host, port = "localhost", 36069
socket = require("socket")
ip = socket.try(socket.dns.toip(host))
udp = socket.try(socket.udp())
```

function LuaExportAfterNextFrame()

```
local pitch, bank, yaw = LoGetADIPitchBankYaw()
socket.try(udp:sendto(string.format("%.2f;%.2f;%.2f", pitch, bank, yaw), ip, port))
```

function LuaExportStop()

```
socket.try(udp:close())
```

3. GRAPHICAL USER INTERFACE

The E69Motion software has been created so that any user with a motion chassis based on SCN5 actuators can have a user-friendly and simple configuration interface.

The interface includes the following elements:

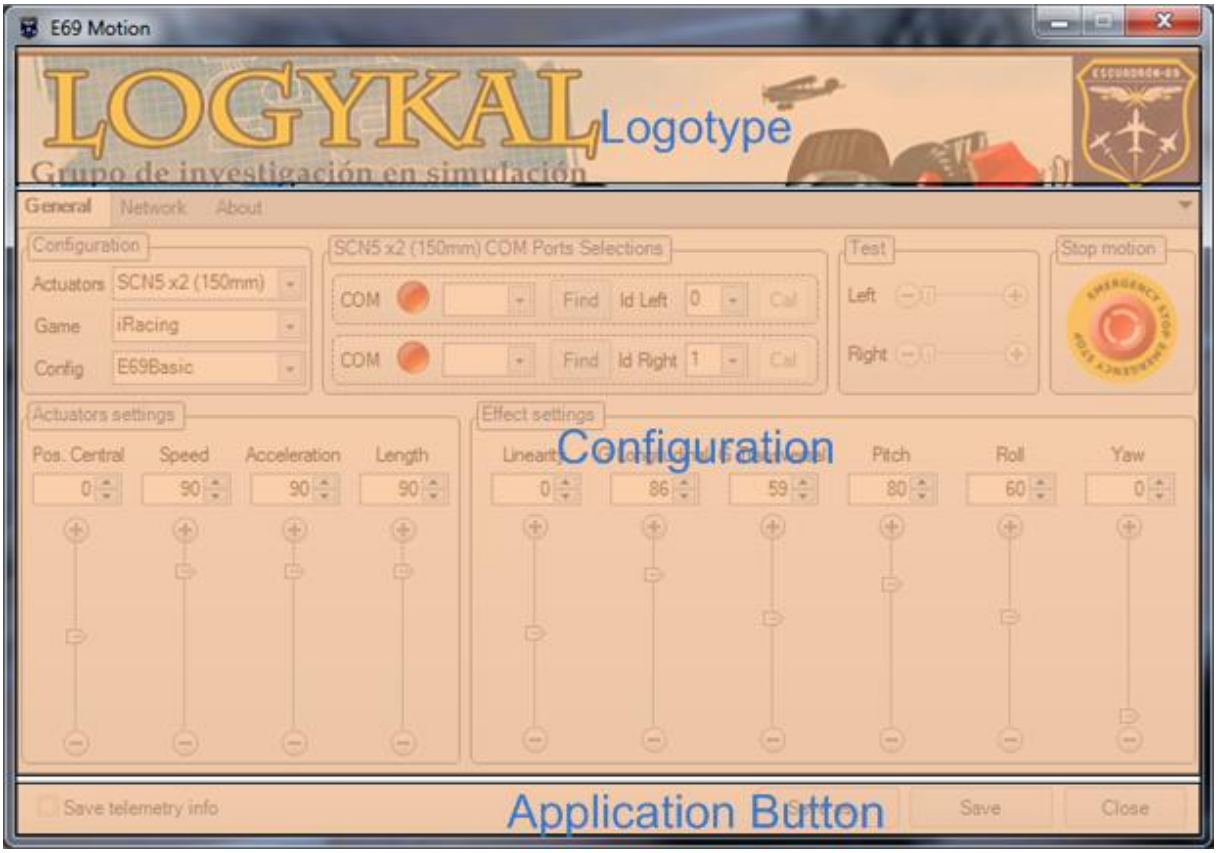

Figure 3-1. Parts of the application

1. **Logykal logo**. Image of the banner of the Logykal work group and the logo of the Escuadrón 69. Clicking on it opens the Logykal web page in an Internet browser
2. **Configuration**. The information has been divided into tabs, each including the following:

- **General**. This includes the controls needed to detect the SNC5 actuators, to calibrate them, perform simple tests, configure the basic parameters of the actuators, configure the effect to be obtained from the seat and an emergency stop.

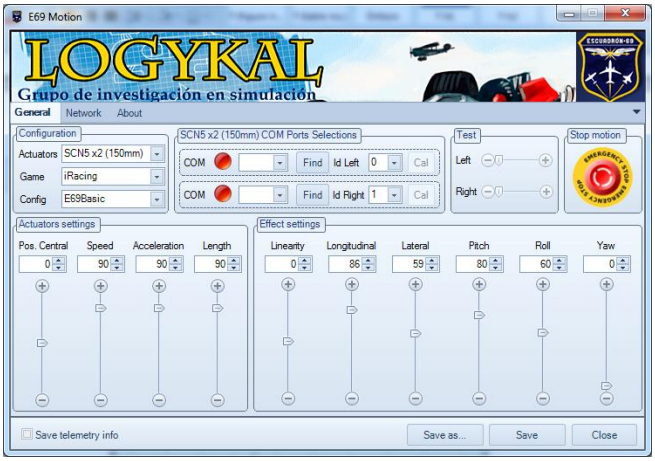

Figure 3-2. General tab

- **Network**. The software can send information on the motion through a LAN network, so controls have been created for its correct handling.

Figure 3-3. Network tab

- **About**. This tab contains information on the Logykal team, supported simulators, version number, etc.

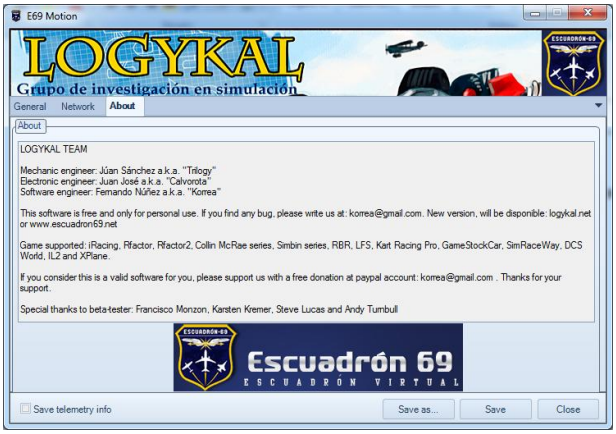
E69 Motion
LOGYKAL
Grupo de investigación en simulación
General
Network
About
About
LOGYKAL TEAM
Mechanic engineer: Juan Sánchez a.k.a. "Trilogy"
Electronic engineer: Juan José a.k.a. "Calvorota"
Software engineer: Fernando Núñez a.k.a. "Korrea"
This software is free and only for personal use. If you find any bug, please write us at: korrea@gmail.com. New version, will be disponible: logykal.net or www.escuadron69.net
Game supported: iRacing, Rfactor, Rfactor2, Collin McRae series, Simbin series, RBR, LFS, Kart Racing Pro, GameStockCar, SimRaceWay, DCS World, IL2 and XPlane.
If you consider this is a valid software for you, please support us with a free donation at paypal account: korrea@gmail.com . Thanks for your support.
Special thanks to beta-tester: Francisco Monzon, Karsten Kremer, Steve Lucas and Andy Turnbull
Escuadrón 69
ESCUADRON VIRTUAL
Save telemetry info
Save as...
Save
Close

Figure 3-4. About tab

3. **Application buttons:** these buttons can be used for the following operations:

- **Close**. Close the application.
- **Save**. Save the selected values of all the parameters with the current profile name. The user will be prompted to confirm the name.
- **Save as**. Save the selected values of all the parameters with a profile name. The user will be prompted to confirm the name.
- **Auto-Find:** Begins an automatic search for actuators to start the application.

3.1 GENERAL

The application will open in the General tab. This tab includes all the system configuration, parameter adjustments and tests.

3.1.1 Configuration

The Configuration tab includes drop-down menus to select the type of configuration of each system, the simulator the information is to be obtained from and the name of the configuration profile to be loaded.

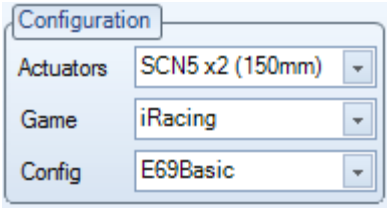

Figure 3-5. Configuration group

3.1.1.1 Actuators

This menu allows the hardware configuration of each system to be selected:

- **SCN5 (150 mm).** System with a single USB-RS485 converter and two SCN5 actuators with a length of 150 mm.
- **SCN5 (100 mm).** System with a single USB-RS485 converter and two SCN5 actuators with a length of 100 mm.
- **SCN5 x2 (150 mm**). System with two USB-RS485 converters. Each converter is connected to a single SCN5 actuator with a length of 150 mm.
- **SCN5 x2 (100 mm).** System with two USB-RS485 converters. Each converter is connected to a single SCN5 actuator with a length of 100 mm.

- **Warner.** Actuators by Warner that will be available in the motion chassis created by Logykal.

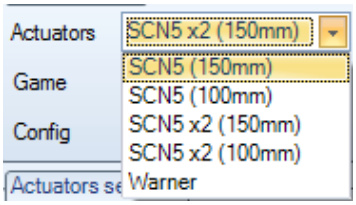

Figure 3-6. List of available actuators

3.1.1.2 Game

This menu lists the simulators supported by the software:

- **Racing simulators**: iRacing, RFactor, RFactor2, GTR, GTL, GTR2, Race 07, GTR Evo, Codemaster Series, Kart Racing Pro, LfS, Richard Burns Rally, Game Stock Car, SimRaceWay.
- **Flight simulators**: DCS World, X-Plane, Flight Simulator X, IL2 1946, Falcon4.

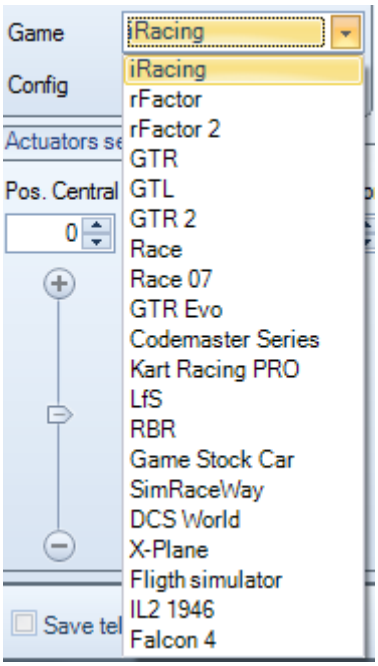

Figure 3-7. List of supported simulators

3.1.1.3 Configuration

Since all vehicles behave differently, the configuration parameters of the actuators and of the effects can be stored in a file generated by the application. This menu can be used to select the stored profile. The values will be automatically loaded in the application and applied instantly.

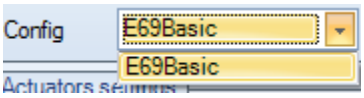

Figure 3-8. List of stored profiles

3.1.2 Com Port Selection

This group of controls changes automatically once the type of system configuration has been selected with the actuator menu so as to adapt to the type of connection used. Whenever a profile is saved, the name of each COM port used is stored so that it can then be loaded when the software is restarted.

3.1.2.1 SCN5

This configuration uses a single USB – RS-485 converter to communicate with two actuators. In this case, each actuator needs to have a different ID. This ID can be changed with the tool provided by the actuator manufacturer.

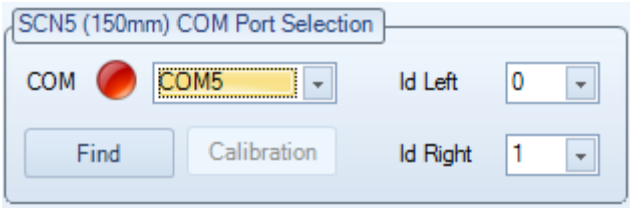

Figure 3-9. Communication with two actuators, one converter

The operation to start the communication with the actuators is as follows:

1. Use the COM selector to select the COM communication port where the converter is connected
2. Use Id Left and Id Right to select the IDs of every actuator
3. Click the Find button. A confirmation message will appear if the detection was successful or not possible.
4. Once the detection has been successful, the Find button will be hidden and the Calibration button will be available. This button calibrates both actuators.

3.1.2.2 SCN5 x2

This configuration uses to USB – RS-485 converters that are connected to a single SCN5 actuator.

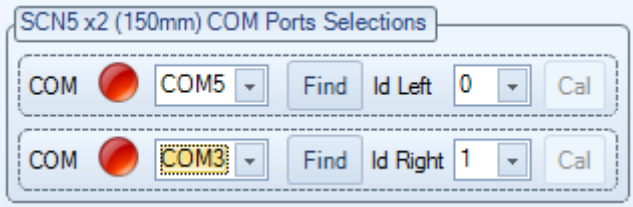

Figure 3-10. Communication with two actuators, two converters

The operation to communicate with two actuators is similar to the SCN5 operation. The same steps have to be followed with both COM ports.

3.1.3 Test

Once the actuators have been located and calibrated, their operation can be verified by means of two sliding controls that send a position to each actuator.

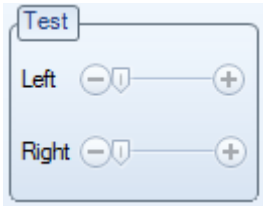

Figure 3-11. Individual simple test of each actuator

These controls stop having an effect on the actuators once the user has opened a simulator.

3.1.4 Emergency stop

The motion can be stopped by clicking on the image of the emergency pushbutton if off-normal system operation is encountered.

Figure 3-12. Emergency pushbutton

3.1.5 Actuator Settings

The application includes a series of settings that provide basic and sufficient control over the actuator operation. These controls affect both actuators simultaneously.

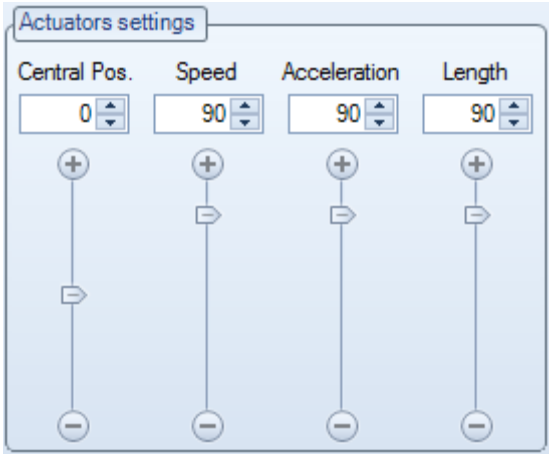

Figure 3-13. Actuator configuration controls

All selectors have a range between 0 and 100 and alter the following configuration:

- **Central Pos.** This particular control does not actuate directly on an actuator motion parameter, but it does alter the intermediate position of the actuator. Depending on the system, there may be a slight difference in the horizontality with respect to the central point of the actuator. Altering the control means the seat may get to be horizontal with respect to the ground.
- **Speed.** Actuators can reach a speed of 400 mm/sec. This control allows the percentage of the maximum actuator speed to be selected.
- **Acceleration.** Actuators have a maximum acceleration of 200 mm/sec^2. This control allows the percentage of the maximum actuator acceleration to be selected.
- **Length.** This control varies the maximum length of motion of both actuators.

3.1.6 Motion settings

All the simulators that are supported in this software generate motion values. These values are exported through the internal API and are then processed so that a position is generated in the actuators to simulate the motion on the seat position.

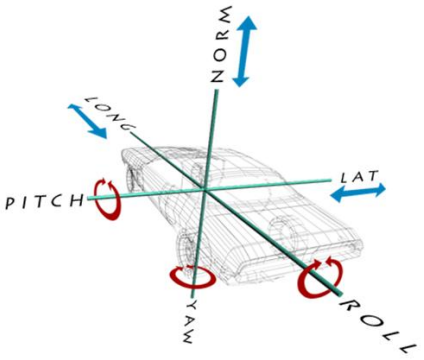

Figure 3-14. Motion axes of a vehicle

The effects provided by every vehicle can be adjusted by means of a series of controls, which range between 0% and 100% of the maximum effects for every simulator.

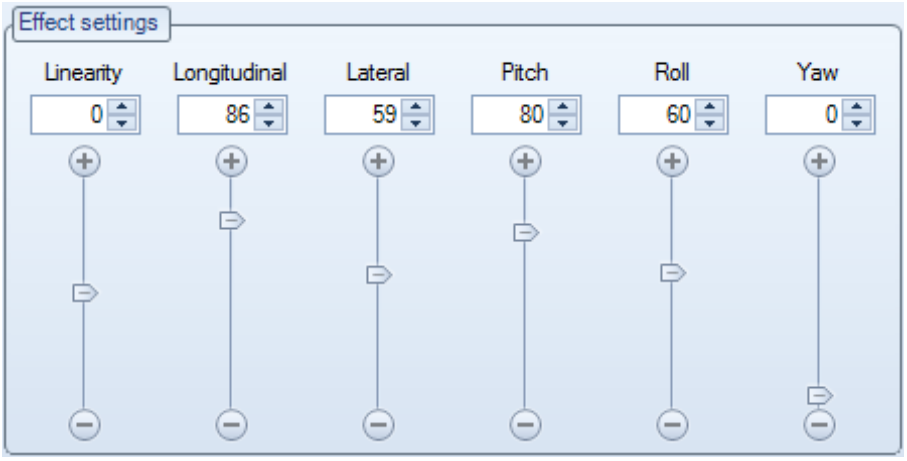

Figure 3-15. Effect configuration controls

- **Linearity.** This modifies the output values respect input variables (vehicle telemetry) with non-linearly signal:

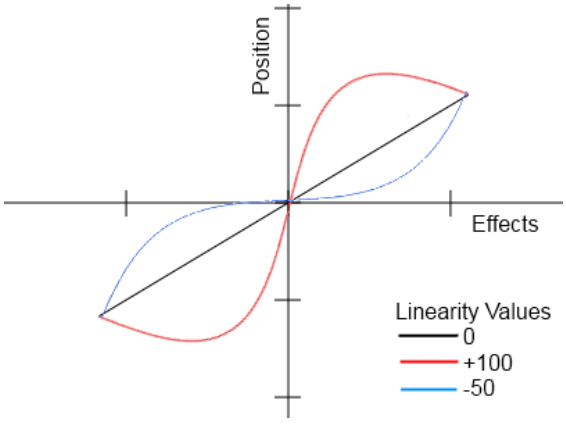

Figura 3-16. Output linearity

- **Longitudinal.** This varies the effect on the seat due to the motion of the longitudinal axis.
- **Lateral.** This varies the effect on the seat due to the motion of the lateral axis.
- **Pitch.** This varies the effect on the seat due to the position of the pitch axis.
- **Roll.** This varies the effect on the seat due to the position of the roll axis.
- **Yaw.** This control will remain inactive until the design of the chassis manufactured by the E69 is complete.

3.2 NETWORK

E69Motion can generate motion information and send it through a LAN network. The receiver is the E69Motion software itself. If this option is activated, the PC where the simulators are executed acts as the server, while the PC where the actuators are connected acts as the client.

3.2.1 Activation

The Network functionality is activated by checking the 'Active network data' control. The active server or client options appear once it is activated. Users will need to select the correct side for each PC.

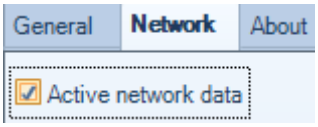

Figure 3-17. Controls for the activation of the Network functionality

3.2.2 Server

This option is activated by following these steps:

1. Activate the Network functionality
2. Select Server on the Select Side menu
3. Type the IP address in the Server IP control
4. Press the Open server button in the Server section
5. Select the correct simulator in General->Configuration->Game

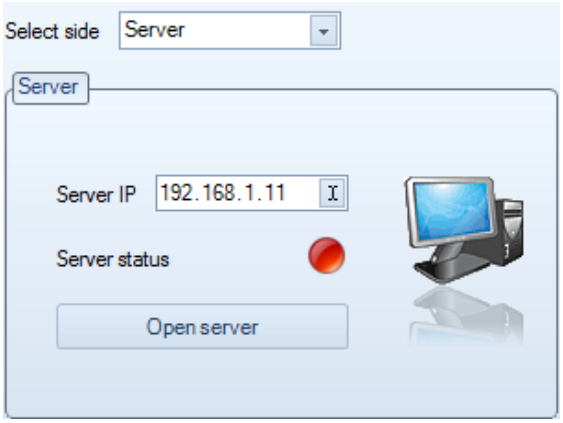

Figure 3-18. Server functionality

3.2.3 Client

This option is activated by following these steps:

1. Activate the Network functionality
2. Select and locate the SCN5 actuators
3. Select Client on the Select side menu
6. Type the IP address in the Server IP control
7. Press the Connect to server button
8. If the connection is made, the Check status LED will appear in green
4. The actuators will now move if the server enters the simulator and starts the vehicle motion

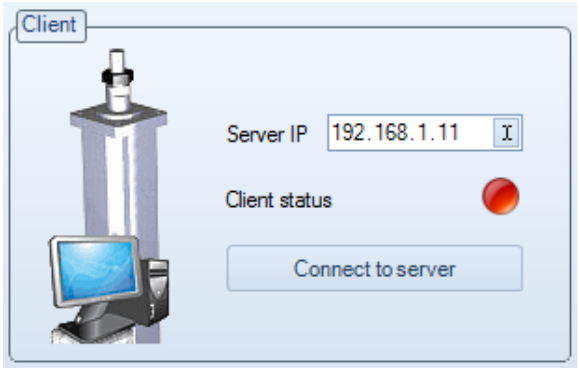

Figure 3-19. Client functionality

3.3 ABOUT

This tab displays information on the members of the Logykal team, the supported simulators, licence, version and acknowledgements. It also includes an image of the Escuadrón 69 logo.

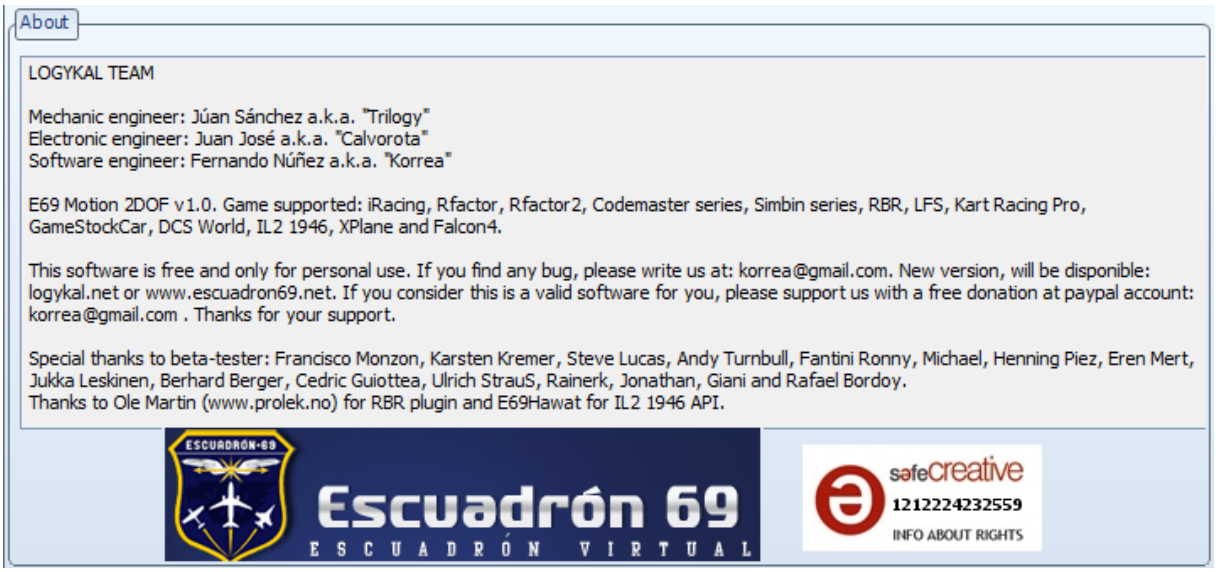
About
LOGYKAL TEAM
Mechanic engineer: Júan Sánchez a.k.a. "Trilogy"
Electronic engineer: Juan José a.k.a. "Calvorota"
Software engineer: Fernando Núñez a.k.a. "Korrea"
E69 Motion 2DOF v1.0. Game supported: iRacing, Rfactor, Rfactor2, Codemaster series, Simbin series, RBR, LFS, Kart Racing Pro, GameStockCar, DCS World, IL2 1946, XPlane and Falcon4.
This software is free and only for personal use. If you find any bug, please write us at: korrea@gmail.com. New version, will be disponible: logykal.net or www.escuadron69.net. If you consider this is a valid software for you, please support us with a free donation at paypal account: korrea@gmail.com . Thanks for your support.
Special thanks to beta-tester: Francisco Monzon, Karsten Kremer, Steve Lucas, Andy Turnbull, Fantini Ronny, Michael, Henning Piez, Eren Mert, Jukka Leskinen, Berhard Berger, Cedric Guiottea, Ulrich StrauS, Rainerk, Jonathan, Giani and Rafael Bordoy.
Thanks to Ole Martin (www.prolek.no) for RBR plugin and E69Hawat for IL2 1946 API.
ESCUADRÓN-69
Escuadrón 69
ESCUADRÓN VIRTUAL
safecreative
1212224232559
INFO ABOUT RIGHTS

Figure 3-20. About tab

3.4 APPLICATIONS BUTTONS

There are the buttons in charge to close, save actual configuration, save actual configuration with another name or begin the auto-search of the actuators.

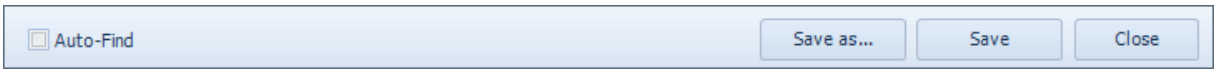

Figura 3-21. Botones de aplicación

- **Close**. Closet he application
- **Save.** Save the actual profile and all general configurations.
- **Save as**. Show a window to enter the new profile name.
- **Auto-Find.** If the user checks the control, you must press Save button. At the next software start, it begin to auto find your actuators.

4. LICENCE

This software is distributed under a Creative Commons – Non-commercial – No derivative works 3.0 licence. The software is freely distributable and only for personal use. Commercial licences may be obtained by contacting the developer, Fernando Núñez Correas, at korrea@gmail.com.

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In addition to the free use for private users, monetary donations are accepted. Any help that can be provided to develop this software will be accepted. Donations can be sent to the following PayPal address: korrea@gmail.com. To use other methods, please contact the developer. Thank you!

5. SUPPORT

If users encounter any problems, they can send the developer an e-mail at korrea@gmail.com. Priority will be given to those users that have made donations to the project.